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A STUDY OF AMNESIC CODING PREFERENCE USING THE PARTIAL INFORMATION TECHNIQUE

by

© CAROLYN LIM

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "A Study of Amnesic Coding Preference using the Partial Information Technique" submitted by Carolyn Lim, in partial fulfillment of the requirements for the degree of Master of Science.

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Date August 26th 1975

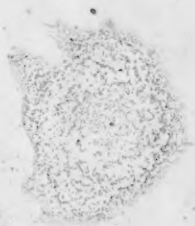
ABSTRACT

In the present study, the extent to which amnesic subjects were able to improve their performance from the provision of antonym, synonym and homonym cues was analysed.

Slides of fragmented words were serially presented such that the most fragmented version appeared first followed by less fragmented versions until an unfragmented level is reached. Subjects were required to verbalize and write down responses while attempting to read each version of the fragmented words. The error score was the number of fragmented versions required prior to the correct identification of the words. After four learning trials, and a distractor task, the same procedure was repeated for six old words and six additional new words. Cue words were now introduced, purportedly to help subjects perform the recognition task better. Analysis of the effects of cueing involved the transformation of difference scores (between the last uncued learning trial and the first cued trial, divided by the former) to a percent score for old words. A similar percent transformation of the difference scores (between the first uncued learning trial and the first cued trial, divided by the former) for the new words was obtained. The transformations were carried out to control for the different levels of learning performance achieved by the different subject groups. Though amnesics were found to be capable of learning, they learned slower and to a lesser extent than normal controls. Results of cueing showed that unlike normal controls, amnesic subjects were unable to demonstrate facilitative effects of cueing from antonym, synonym or homonym cues.

Discussion of the results included the possible limitations of

the experimental learning paradigm employed to present fragmented stimulus materials to amnesics when encoding processes were the key issues to be considered.



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INTRODUCTION

The amnesic memory impairment has been conventionally understood in terms of a deficient consolidation process, regardless of the etiology of the memory loss, (e.g., trauma, Russell, 1968; and Schwartz, 1971; left temporal lobectomy, Weingartner, 1968; and Blumer and Walker, 1969; Korsakoff syndrome, Talland, 1965; Murray and Hitchcock, 1973; or transient global amnesic states, Shuttleworth and Morris, 1966). The pathology was seen as resulting from the disruption, or absence, of a period of normal brain processes which ordinarily allow for a repetition of ongoing events--a reverberation of experiences necessary for the establishment (consolidation) of a proper memory trace. The actual perception and encoding of incoming material were not generally implicated (Warrington and Weiskrantz, 1971), and retrieval of consolidated material was usually assumed to be normal, or not considered because of the difficulty involved in differentiating the process of retrieval from that of retention (Seltzer and Benson, 1974).

Recent evidence provided by the British investigators Warrington and Weiskrantz (1968a, 1970) has produced a basis for a different emphasis in research on memory pathology. According to these investigators, amnesic patients do not suffer from consolidation disruption but rather remember too well and too unselectively. The result is presumed to be a susceptibility to interference as a consequence of the amnesic tendency to be unable to inhibit the recall of unwanted, irrelevant material. From this view point, a test method which reduces interference should allow amnesics to do considerably better. Amnesic patients have indeed been shown to have good retention of

verbal or pictorial stimulus materials when these materials were presented by the partial information technique which restricts response alternatives (Warrington and Weiskrantz, 1968b). In the Warrington and Weiskrantz (1968b) experiment, stimulus materials were serially presented in decreasing degrees of fragmentation from an unclear, most fragmented state to a clear unfragmented state. Considerable savings were obtained even with amnesic patients when retested as long as four weeks after the original learning. When the partial information method of retrieval was compared with the conventional methods of recall and recognition, Warrington and Weiskrantz (1970a) found that amnesics do much better with the first method. Furthermore, Winocur and Weiskrantz (1974) have found that while unrelated verbal paired-associates were not learned by amnesics, when all paired items of a list were related by either a semantic (battle-soldier) or phonemic (rays-raze) rule, the lists could be acquired by the same category of patients. The authors proposed that the problem of the amnesic memory impairment would thus seem to center around the process of retrieval and not consolidation. The partial information method of stimulus presentation as well as the pairing of words according to a single dominating rule serves a similar purpose of reducing interference by restricting response possibilities during retrieval.

Therefore, whereas consolidation theorists contended that interference prohibits the rehearsal of information for later recall, thereby causing difficulties with the processing of a permanent memory trace, Warrington and Weiskrantz (1970a) argue that the problem arises during retrieval. Too much interference during retrieval as a consequence of an unselective memory causes retrieval difficulties because

the remembered material cannot be sufficiently well segregated. Hence, learning of new material is impeded because of pro-active interference. When such interference can be minimized, e.g., by word-associates combined according to certain rules, by the partial information method or any test method that succeeds in reducing response possibilities, amnesic subjects have been observed to be capable of good retention.

Encoding (i.e., categorization) deficiencies have been put forward by Cermak and Butters (1972) and Cermak, Butters and Gerrein (1973) as an additional and similarly important contributory factor in the memory deficits of amnesics. When categorical cues were given both before stimulus presentation (pre-cueing) and during recall (post-cueing) for the immediate retrieval of words belonging to the categories (e.g., animal-dog, cat; profession-carpenter, plumber), amnesic patients fared worse than when there was neither pre-cueing nor post-cueing. However, they performed better in the cued recall (with both pre- and post-cueing) than the free recall condition when a one minute delay period was introduced between learning and recall (Cermak, et al. 1973). It would thus appear that while amnesics are capable of free recall immediately after learning, their memory is grossly impaired when a delay period is introduced. While cued recall does not improve amnesic performance over free recall under immediate retrieval conditions, cued recall aids amnesic retrieval when interference as a consequence of a task interpolated for as long as one minute interrupts immediate memory. Thus it would seem that amnesics do not spontaneously use semantic encoding strategies even though they are capable of benefiting from the forced usage of such strategies.

Cermak, et al. (1973) also observed that amnesics were much more likely to erroneously recognize homonyms and associates, (but not synonyms) as repeated stimulus words in an old-new recognition task. On the other hand, the amnesic's tendency to recognize semantically related words as repetitions of stimulus words was not different from the normal controls' general tendency to make such false recognition errors on homonyms, associates or synonyms. Cermak, et al. explained their results in terms of the amnesic patients' encoding preference, i.e., amnesics were assumed to tend to rely spontaneously on associative and phonemic dimensions but not on semantic dimensions. The authors suggest that the impaired ability to spontaneously utilize semantic encoding may underlie the amnesic's deficiency in retaining verbal material.

Cermak, et al.'s (1973) findings would thus seem to question Warrington and Weiskrantz's (1971) assertion that amnesics have normal mechanisms of organization or encoding. Warrington and Weiskrantz (1971) had previously found that amnesic patients showed no evidence of impaired perceptual classication. Amnesic and control subjects alike could by visual analysis correctly classify geometrical designs as alike, not alike, identical or not identical to a displayed standard or a memorized standard. Moreover, the authors did not find any abnormality in the manner in which amnesics responded to materials generally resulting in the von Restorff effect. Though amnesics recalled and recognized less than controls in the overall analysis, they were nevertheless similarly influenced by the von Restorff phenomenon and recalled the isolated items better than homogeneous items. Finally, Warrington and Weiskrantz (1971) found

that there was no significant difference between amnesic and control performance on semantic categorization or clustering. Whether recall was unlimited, or limited to two or four categories did not differentially affect the amnesic patients' nor the controls' performance. The authors contend that amnesic organization/encoding processes in these tasks were comparable to that of control subjects, and could not account for the amnesic pathology.

The present study was designed to test the hypothesis that amnesic patients indeed choose associative and phonemic encoding dimensions spontaneously over and above semantic dimensions. The subjects were first presented the learning materials by the fragmented procedure. After a brief distractor task, the learning materials were again presented but different items were accompanied by an antonym, synonym or homonym cue word. Based on the Warrington and Weiskrantz (1968, 1970, 1971) findings, it was anticipated that the amnesic patients would be able to learn the verbal materials with the partial information technique though they would do so at a slower rate than control subjects. Of primary interest was the effect of cueing. According to Cermak, et al., the poorer overall performance of the amnesics should be associated with differential effects of cueing. Specifically, an over-reliance on phonemic and associative encoding processes should be evidenced by greater cueing effects being obtained with cues from these dimensions.

METHOD

Subjects. One amnesic and two control groups participated in the research. The ten patients of the Amnesic (Am) group each had a severe memory defect as assessed by clinical methods. Four of these patients were alcoholic Korsakoffs, three had left temporal-lobe dysfunction, one had had a left temporal lobectomy, and two were suffering from post-traumatic amnesia. The average age of these patients was 51.4 years and they had, on the average, a Grade 10.2 education.

One control group (Hospital Control, Hc) consisted of eleven patients with no known verbal memory defects, matched as closely as possible with the amnesic patients for age, and educational background. One of these patients had right temporal dysfunction and one had had a right temporal lobectomy. For the remaining nine, there was nothing in their case reports that would incriminate them as having positive cerebral neurological dysfunction. The average age was 46.4 and average grade completed was Grade 10.3.

The Normal Control (Nc) group was drawn from the hospital housekeeping staff and ward aids. None of these six subjects had had any cerebral neurological diseases. The average age was 39.3 and the average grade completed was 9.7.

Materials. Fragmented versons of two sets of six four letter words were prepared to achieve five levels of word completeness. As can be seen in Appendix B, the fragmentation sequence runs in order of presentation from 10%, 20%, 30%, 40%, to 100% completeness. The different levels of completeness were achieved by preparing

opaque grids sectioned into 7 X 188 mm squares and removing an appropriate number of squares such that each grid had the respective percentage of area exposed. The grids were then placed over the complete word, photographed, and slides made for presentation. Table 1 shows the 12 stimulus words and their respective cue words. The cue words were photographed uncovered, and made into five by eight inch prints. Both the fragmentation sequences and the cue words were presented as white images on black backgrounds.

Two sets of words (Set A and B) were used in an attempt to mitigate item specific effects. For some subjects in each group, Set A served as learning items and Set B served as new items on the cued retention test. The function of Set A and B words was reversed for the remaining subjects.

Three kinds of cues were used--antonyms (A), synonyms (S), and homonyms (H). According to the Thorndike-Lorge word count, stimulus and cue words of the A, S, and H Cue-Types were in general of AA, A and <A frequency respectively.

Procedure and design. All subjects were given four learning trials, a distractor task, and a cued retention test. All words were learned and tested for retention by the partial information technique. Thus, for each single word, the items in the fragmentation sequence were presented successively, beginning with the most incomplete (most fragmented) version and progressing to the complete (unfragmented) word. The materials were presented via a Kodak Carosel slide projector at a subject-paced rate. With each presentation, the subject verbalized his identification or indicated that he was unable to recognize the item. He then wrote the response in a

Table 1

Set A and B Stimulus and Cue Words

	Set A		Set B	
Cue Type	Stimulus Word	Cue Word	Stimulus Word	Cue Word
Antonym	Rich	Poor	Fast	Slow
Antonym	Take	Give	Hard	Soft
Synonym	Wish	Want	Tidy	Neat
Synonym	Hurt	Ache	Drab	Dull
Homonym	Liar	Lyre	Rays	Raze
Homonym	Fare	Fair	Sail	Sale

prepared response booklet.

During the four learning trials, 120 slides (5 levels x 6 words x 4 trails) were presented without a break. This required about 30 minutes on the average. Although the sequence of fragmented versions was always from least to most complete for each word, the order of the six words was randomized over the four trials to prevent serial learning. Instructions to the subject at this stage did not reveal the possibility of a subsequent retention test.

Following the learning task, the subject was moved to another location in the room and given the Memory for Designs test. The test served as a distractor task and provided an evaluation of the subject's non-verbal STM. At the completion of the distractor task (approximately 10 minutes) the subject was returned to his original chair for the cued retention test.

All experimental manipulations occurred at the time of the cued retention task. The subjects were instructed that fragmentation sequences of six new words could be presented as well as those for the six old words. The 12 fragmented sequences were cued by a related (unfragmented) word presented in a position juxtaposed to the fragmented versions of the test words. Two of the old and two of the new test words were cued by antonyms, two of each by synonyms, and two of each by homophones. Again the fragmentation sequence was retained such that successive presentation of the fragmented items from least to most complete version ensued for each single word, but the order of the 12 words and their respective cues was randomized over subjects to prevent cue-type priming effects. Subjects were instructed to read the cue word aloud and to use it to help them

identify the fragmented word. Responses were made in the same manner as during the learning trials. After the cued retention test, the subjects were requested to write down as many of the 12 fragmented and 12 cue words as they could remember. All instructions can be found in Appendix A.

Overall, the design consisted of a 3 X 3 X 6 (3 Groups: Am, Hc, Nc X 3 Word-Types: A, S, H X 6 Trials: 4 Learning Trials, X 2 Types of Fragmented items: old vs new) factorial design with repeated measures on all variables except for that of Groups. Most analyses were based on error scores. The error score was the number of fragmented versions required prior to the correct identification of the word.

RESULTS

Learning. Two sets of materials (Word Set A and B) were used in an attempt to minimize item specific effects. A preliminary analysis including Word Sets as a variable did not indicate Set A and B to be of differential difficulty overall, $F(1, 25) = 1.86$, $p > .10$, nor was there an indication that the two Word Sets differentially affected the performance obtained with the three subject groups. Although the Word-Types[1] within Set A and B were not of equal difficulty, $F(2, 50) = 14.4$, $p < .01$, this interaction was observed in the performance of all subject groups. Since there was no interaction involving the Groups variable, the data obtained with both Word Sets were combined in the following analyses.

Table 2 shows the error scores across the four learning trials for the three Word-Types for each subject group. A visual inspection of the overall means reveals a decrease in errors for all groups as they proceeded from Trial 1 to Trial 4. The learning indicated by the decrease in errors was reliable in the overall analysis, $F(3, 72) = 40.94$, $p < .01$, and was also reliable when the data from each group was separately analysed, smallest $F(3, 27) = 7.83$, $p < .01$. Thus, amnesics as well as controls were capable of learning by the partial-information technique. The Groups did not, however, learn at the same rate. This observation was confirmed by a reliable effect due to

---

[1]Word-Type is a pseudo classification during the learning trials. This designation is in terms of the manner in which the items were cued at the time of the cued performance test, i.e. with antonym (A), synonym (S), or homonym (H) cues. During cued performance, this variable is re-designated Cue-Type and represents an actual classification based on the provision of the different cue types.

Table 2

Mean Error Scores for the Four Non-Cued Learning Trials for the A, S, and H Items of the Lists Given to Each Group

		Trial				
Sub Group	*Word Type	1	2	3	4	Mean
Amnesic	A	3.8	3.2	3.1	2.7	3.2
	S	3.6	3.6	3.2	3.0	3.3
	H	3.8	3.7	3.4	3.2	3.5
	$\bar{X}$	3.7	3.5	3.2	3.0	3.4
Hospital Control	A	3.5	3.1	2.7	2.4	2.9
	S	3.6	3.2	2.7	2.6	3.0
	H	3.8	3.4	3.1	3.1	3.4
	$\bar{X}$	3.6	3.3	2.9	2.7	3.1
Normal Control	A	3.3	2.3	1.7	1.6	2.2
	S	3.4	2.4	2.0	1.8	2.4
	H	3.5	2.9	2.6	2.5	2.9
	$\bar{X}$	3.4	2.6	2.1	2.0	2.5

*Pseudo classification during learning.

Groups, $F(2, 24) = 6.23$, $p < .01$, and supported by a substantial interaction produced by the Subject Group and Trial variables, $F(6, 72) = 2.00$, $p < .08$. Separate comparisons of the means obtained for the three groups indicated that the performance obtained for the amnesics and hospital controls could not be differentiated, $t = 1.10$, $p > .10$, but that both seemed to learn at slower rates than did normal controls, smallest $t = 2.32$, $p < .05$.

Reflecting the different Thorndike-Lorge frequencies of the A, S, and H Word-Types, a reliable effect due to the Word-Type variable, $F(2, 48) = 10.72$, $p < .01$, was obtained. This significant difference, and the interaction between the Word-Type and Trials variable, $F(6, 144) = 2.25$, $p < .05$, indicate the A, S, and H words were of unequal difficulty. Though the absence of a reliable interaction between the A, S, and H items and the Groups variable ($F < 1.00$) suggests the differential difficulty of the A, S, and H words was common to all groups, it is not known how this differential difficulty may have affected the cued performance.

To recapitulate, all subject groups demonstrated learning, though not at the same rate, nor to the same degree. The three subject groups were not differentially affected by the variability attributed by Word Set, Word-Type, Word Set by Word-Type interaction and the Word-Type by Trials interaction.

Cued performance. It will be recalled that there were two classifications of fragmented items presented during the cued-performance task: Old Items (those presented during the four learning trials), and New Items (items not previously presented). Consider first the performance obtained with the Old Items. The differential levels of learning ob-

tained by the groups and the unequal difficulty of the Old Items necessitated that the cued performance scores be adjusted in terms of the original learning performance. In order to accomplish an adjustment, the error data for each subject were converted to percent gain scores by the formula: 100 X (Last learning Trial - Cued Performance Trial) ÷ Last Learning Trial. With this type of correction, a minus score represents performance during the cued performance task inferior to that obtained on the last learning trial, whereas a positive score represents a gain in performance compared to that obtained at the end of acquisition. The percent gain scores are shown in Table 3.

In general, for Old Items, cueing per se benefited normal controls more than either the hospital controls or the amnesics, smallest t = 2.14, $p < .05$. Normal controls derived an average facilitation of 36.1%, whereas hospital controls achieved an average gain of 11.6%, and amnesics derived 0.7% facilitation on the average. Thus, the amnesic subjects' performance showed almost no improvement that could be attributed to the effects of cueing. For all three subject groups, despite some rather large differences, there was no reliable difference between effectiveness of the various Cue-Types, largest t = 1.72, $p > .05$. This observation indicates that Cue-Type does not feature as a significant factor in the variability of scores for the performance of learned words.

Consider now the cued performance with the New Items. Again a correction was deemed necessary since there was a trend for the three types of items (Word-Types A, S, H) to be differentially difficult on the first exposure (see Trial 1 Learning data). The same formula was applied for the transformation of the error scores for the New Items with the appropriate change in base level, i.e., 100 X (First Learning Trial - Cued Performance Trial) ÷ First Learning

Table 3

Percent Gain Scores For Old Items

Sub Group	Word-Types			
	Antonym	Synonym	Homonym	Mean
Amnesic	2.8	1.7	-2.4	0.7
HC	18.4	0.8	15.6	11.6
NC	44.2	45.8	18.3	36.1
Mean	21.8	16.1	10.5	16.1

Trial.

The percent gain scores obtained for the New Items are shown in Table 4. Comparisons of the scores obtained for the three groups again indicate that in general, normal controls derived greater overall benefits from cueing than either hospital controls or amnesics, smallest $t = 3.15$, $p < .05$. Amnesics did not derive any facilitation from the provision of synonym or homonym cues, although they were able to derive substantial benefits from antonym cues. This reliable difference in cue effectiveness (for amnesics, smallest $t = 2.01$, $p < .05$) is again observed in the normal controls' performance where both antonyms and synonyms are found to provide greater facilitation than homonyms (smallest $t = 2.65$, $p < .05$).

Thus, though large differences among Cue-Types were found in the performance of Old as well as New Items, specific t tests indicated these differences to be reliable for only the New Items.

There was no significant difference between the magnitude of the two estimates of cued gain (percent gain scores for Old versus New Items), ignoring Cue-Types, for any of the groups. When Cue-Types were considered, this same observation was found to be true for all groups with one exception. The two estimates of cued gain for Old and New Items under the homonym cueing condition were significantly different for normal controls $F(1, 5) = 8.21$, $p < .04$. Percent gained as a possible result of cueing new words was -3.2, whereas a gain of 18.3 was obtained when old words were cued. This observation implies that while homonyms may be ineffectual when cueing unknown targets, they are effective for the cueing of words from a recently learned set with normal controls.

Table 4

Percent Gain Scores For New Items

	Word-Types			
Sub Group	Antonym	Synonym	Homonym	Mean
Amnesic	11.5	-4.9	-2.9	1.3
HC	6.1	6.4	1.9	4.8
NC	46.7	36.4	-3.2	26.6
Mean	21.43	12.63	-1.4	10.9

During cued performance, a number of errors consisted of writing the cues themselves as responses when attempting to recognize the fragmented words. Table 5 shows the breakdown for each subject group of the percent distribution of these direct intrusions for the Old and New Items. The normal controls did not make any such cued intrusion errors whereas hospital controls seemed to make more or less evenly distributed direct intrusion errors with antonmys, synonyms and homonym cues. Amnesics on the other hand, seemed to be unique in their tendency to make direct intrusion errors of homonyms for both Old and New Items. The implication here is that normals are more discriminative in their responses than either hospital patient group, and that amnesics are less discriminative of words that look and sound like stimulus words than words that are semantically or associatively related to them.

Since a free recall task was given at the end of the testing session for each subject, it is of some interest to compare the recalled words of each subject group with respect to their Word-Type or Cue-Type classification. Table 6 shows the percent distribution of recalled words over the three Word-Types for the learned old words (exposed five times), new words (exposed once), and over the three Cue-Types for the cue words (exposed once). Descriptively, in the recall of old words, amnesics did worse than either hospital or normal controls though all three groups of subjects recalled from the three Cue-Types in a more or less evenly distributed manner. Fewer new and cue words were recalled by subjects than old words, with amnesics and hospital controls recalling less than normal controls. None of the differences were statistically significant.

Table 5

Percent Distribution of Direct Intrusions for Cue-Types of Old and New Items in Each Subject Group

	Old Items				New Items			
Sub Group	Ant	Syn	Homo	$\bar{X}$ Freq.	Ant	Syn	Homo	$\bar{X}$ Freq.
Amne	16	16	67	0.6	0	20	80	0.5
HC	28	39	33	1.6	27	27	47	1.4
NC	-	-	-	0.0	-	-	-	0.0

Table 6

Percent Distribution of Recalled Words for

Word- and Cue-Type in each Subject Group

Sub Group	Ant	Syn	Homo	$\bar{X}$ Freq.
	Old Words (exposed five times)			
Amne	33	33	33	1.5
HC	35	23	42	2.4
NC	35	35	30	3.3
	New Words (exposed once)			
Amne	40	20	40	0.5
HC	75	0	25	0.5
NC	36	18	45	1.8
	Cue Words (exposed once)			
Amne	40	40	20	1.0
HC	60	20	20	0.5
NC	38	19	44	2.7

Memory for Designs Test. The Memory for Designs test scores revealed that perhaps amnesics and hospital controls had poorer non-verbal STM than normal controls. Amnesics and hospital controls scored 12.1 and 14.2 respectively, whereas normal controls has a score of 3.5.

DISCUSSION

The results substantiate previous findings (Warrington and Weiskrantz, 1968) that amnesics are capable of relatively rapid learning when the stimulus material is presented by the partial information technique. In line with Warrington and Weiskrantz's (1968, 1970 and 1971) observations, amnesic subjects were nevertheless comparatively slower than control subjects in their rate of acquisition. However, the performance of the amnesic subjects was not reliably different from that of the hospital controls.

The earlier findings of Cermak, Butters and Gerrein (1973) that amnesics tended to rely on associative and phonemic encoding attributes rather than on semantic dimensions were not supported by the present findings. Amnesic subjects were observed to show a general lack of facilitation from associative, phonemic and semantic cueing as compared to the far greater facilitation for the normal controls. Hospital controls tended to be more amenable to cueing than amnesics, though their performance under cued conditions was comparatively inferior to that of the normal controls. This reliable difference would seem to imply that whereas normal controls were able to utilize cues efficiently along associative, semantic and phonemic dimensions, neither the performance of the hospital control nor amnesic patients demonstrated the same efficiency.

In combining the findings of the present study with those of Cermak, et al. (1973), how may amnesic deficits be interpreted? Cermak, et al. (1973, Exp. I) observed that semantic, phonemic and associative cues could effectively facilitate the retrieval performance of both amnesics and controls after a retention interval

Given categorical cues (vegetables, flowers), amnesics as well as controls improved their recall performance for words that belonged to the categories (vegetables--spinach, cabbage; flowers--daisy, rose). Similarly, rhymes and primary-associates were likewise facilitative cues for the recall of words. However, when a recognition task was given in another experiment (Cermat et al., 1973, Exp. IV), amnesic subjects made predominately phonemic (bear-bare) and associative (table-chair) rather than semantic (robber-theif) false recognitions. In fact, the amnesic subjects made as few semantic false recognitions as the normal-subject group. The authors concluded that the amnesic deficit involved an excessive reliance on associative and phonemic encoding strategies and an impaired ability to utilize semantic encoding strategies. The apparent contradiction between Cermak, et al.'s (1973) findings and the present study would seem to suggest either that the question of amnesic encoding has been inappropriately formulated or that the answer depends on the paradigm used.

In the present study, both the orienting task and the intentional strategy in the experimental learning paradigm required subjects to pay attention to the structural features rather than the meaning of the visual stimulus. It is thus difficult to know for certain what, if any, coding strategy was used, or at what level the stimulus materials were analysed. There is substantial evidence in the existing data on incidental learning to support the contention that recall after an orienting task that required processing (by cognitive encoding) stimulus materials to a semantic level was superior to recall of words from equivalently exposed stimulus materials which were processed nonsemantically (perceptually analysed--with physical

or sensory features being mainly attended to), Craik and Lockhart, 1972). Subjects who scanned a list of words for structural targets (e.g., words containing the letter A) were less retentive of the words than subjects who scanned the same list for words denoting living things (with scanning time per word controlled), (Schulman, 1971). Memory performance would thus appear to be related to the level of processing required by the orienting task. Furthermore, Craik and Lockhart (1972) proposed that even with the provision of retrieval cues, their effectiveness as cues depends on their compatibility with the cued items' initial encoding.

The amnesic subjects in the present experiment may not have been able to derive facilitative effects from the provision of cues for various reasons. If the amnesics did not analyse the stimulus material further than simply attending to their visual-structural features, then the initial encoding of these items is incompatible with the necessary processing of the presented cues for effective cueing. An alternative reason would be that amnesics, as brain damaged persons, are incapable of operating with alternate sets (Talland, 1968), or are restricted to concreteness and the physical stimulus but not the abstract--the meaning of the words (Goldstein, 1952). To try to read fragmented words is a task in itself. The additional requirement to attend to the cues was perhaps exceptionally distracting, as a result of which amnesics were unable to benefit from their provision.

The hospital controls' general inability to benefit from the provision of cues may again reflect the incompatibility of initial coding and subsequent retrieval operations. It is unlikely that their lack of facilitation would stem from impairment as a direct

consequence of brain damage.

Normal controls were capable of deriving beneficial gains from all cues except homonym cues for the new words. The implication is that even when the orienting task only requires a perceptual analysis, normal controls are probably more capable of the semantic processing of stimulus material than hospital patients. The observation that normal controls benefited from the provision of homonym cues for old but not new words was unexpected, but interesting. It may be that for old words, i.e., words that have been recently reviewed, homonym cues trigger off search operations which make these recently rehearsed words available. For new words, i.e., words in the verbal repertoire but not immediately accessible, homonym cues are not facilitative because the spontaneous and initial processing of cued items by normal controls are semantic and not phonemic.

The direct intrusion data presented herein suggests that normal controls were discriminative against making intrusion errors with the homonym, antonym and synonym cues of the stimulus words. On the other hand, hospital controls seemed not to be discriminating against making direct intrusion errors since they made the greatest number of such errors, and these intrusions were given more or less equally to all three Cue-Types. The amnesic subjects were also less discriminating against making erroneous intrusion responses, but the intrusions were primarily given when homonym cues rather than either antonym or synonmy cues were presented. However, it did not follow that amnesics would remember homonyms better than the antonym or synonym cues of the stimulus words. In fact, as can be seen in the recall data (see Table 6), amnesics seemed to recall homonym cues

less well than synonym or antonym cues. Since the intrusion errors were only made by a small percent of amnesics, and few words were actually recalled, the following discussion is made with much reservations, emphasizing not the statistical reliability, but the interesting trend of the available data.

In 1974, Kinsbourne and Wood proposed that there is an amnesic phonemic retrieval deficiency particularly in their greater tendency to apply lax criteria for the retrieval of words based on phonemic qualities. The idea of an amnesic impairment in the loose categorization of information for encoding or retrieval is not new. In 1958, Talland proposed the idea that there were "certain principles of classification" (encoding or retrieval) that amnesics were predisposed towards using in an inappropriate and loosely bound manner. This predisposition involved a tendency to form loose boundaries of categorization, and a reluctance to adopt different attributes for criterion even in the face of obvious failure of initially chosen attributes. Talland suggested that shape and utility were some of these principles of classification towards which amnesics were predisposed. According to Kinsbourne and Wood (1974), sound could be another examplar.

The intrusion data in the present study would appear to support Kinsbourne and Wood's proposal of amnesic impairment in the retrieval of phonemic related words. The larger percent of homonym direct intrusions in amnesic responses may indicate that homonyms were more acceptable and classifiable as "correct fit" for the fragmented stimulus words according the shape and sound principles. In fact, with respect to sound attributes, the use of homonyms made the fit

exact in both the present study and that of Cermak, et al. (1973). Antonyms and synonyms seemed in comparison to be less acceptable. The possibility that antonyms and synonyms were meaningfully related was likely to have been turned down because of the obvious lack of fit for the shape and sound attributes of these cues into the presented fragmentations. Thus, amnesics may have preferential principles of classification under which lax criteria are established for the processing of impinging information.

In summary, results from the present study do not reliably support the contention that amnesics are excessively reliant on phonemic and associative attributes, and not sufficiently adept with the usage of semantic encoding strategies. The author puts forward the explanation that the experimental technique may have emphasized other features, e.g., structural, thus mitigating against a decisive test of the hypothesis.

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APPENDIX A

INSTRUCTIONS TO SUBJECTS

Verbal Task

We are interested in finding out how clear a word has to be before it can be read by every one. Therefore, these slides are made so that they are very unclear at first, becoming clearer and clearer later on.

There are five slides of six words here that will be shown you several times. For each word, the first slide will be difficulty to read because it is very unclear. The second, third, fourth, and fifth slides will get easier and easier to read because they will get clearer and clearer.

To make these slides, suppose we put this cover (10% grid) over this label X before we take a picture of it. As you can see, very little of X is shown. However, as we replace this cover (10% grid) with this (20% grid), more of X is seen. And so, X gets clearer and clearer and clearer as we change from this cover (10% grid) to this cover (clear glass).

Label X	10%	20%	30%	40%	
					(clear glass)

were shown to the subject.

Here is a pencil to write with.

This booklet is here for you to write on. I would like you to tell me what word you think each slide looks like, and to write the word down here on this booklet. For an example, let's look at the first slide. Let's find out what word this slide looks like. If it does not look like any word you know, put a dash on the first line. (Show where and how.)

O.K. What word do you think this looks like?

_____ Write that down here.

or

_____ Put a dash here.

Now let's go to the next slide. But before we do that, do you have any questions?

Inter-Trial Task

You have done very well with reading (and writing down) these words that were quite unclear.

Now I have something different for you to do. I have 15 patterns I would like you to draw for me. Here are some pieces of paper to draw on. Each pattern will be shown for five seconds. After the five seconds, I would like you to draw the pattern for me.

Do you have any questions?

O.K. Here is the first pattern. Remember, don't start drawing until five seconds are up. I will tell you when to start drawing. Ready?

Final Task

Good. Now let's look at some more slides. This time, I will show you a word printed on a card like this (show 5" X 8" care) which may help you decide what word the slide looks like. Here is a booklet to write on. Are you ready?

First slide.

Now, this word may help you read the slide. If it does not help you, don't pay any attention to it. (Show appropriate cue word.)

Second slide.

This word here may help you read the slide. (Point to same cue word.)

Third slide.

Fourth slide.

Fifth slide.

Sixth slide (different word).

This word here may help you read the slide. (Replace last cue word with the appropriate cue.) Second, Third, Fourth, Fifth slide--silence.

(If asked--Yes this word may help you read the slide easier.)

APPENDIX B

MATERIALS AND ORDER

LABEL X

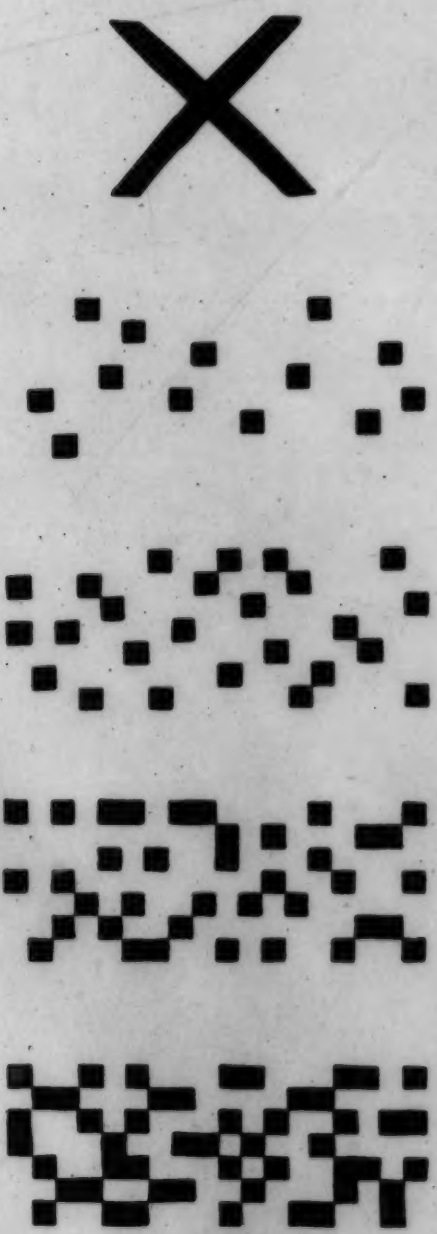
GRIDS

10%

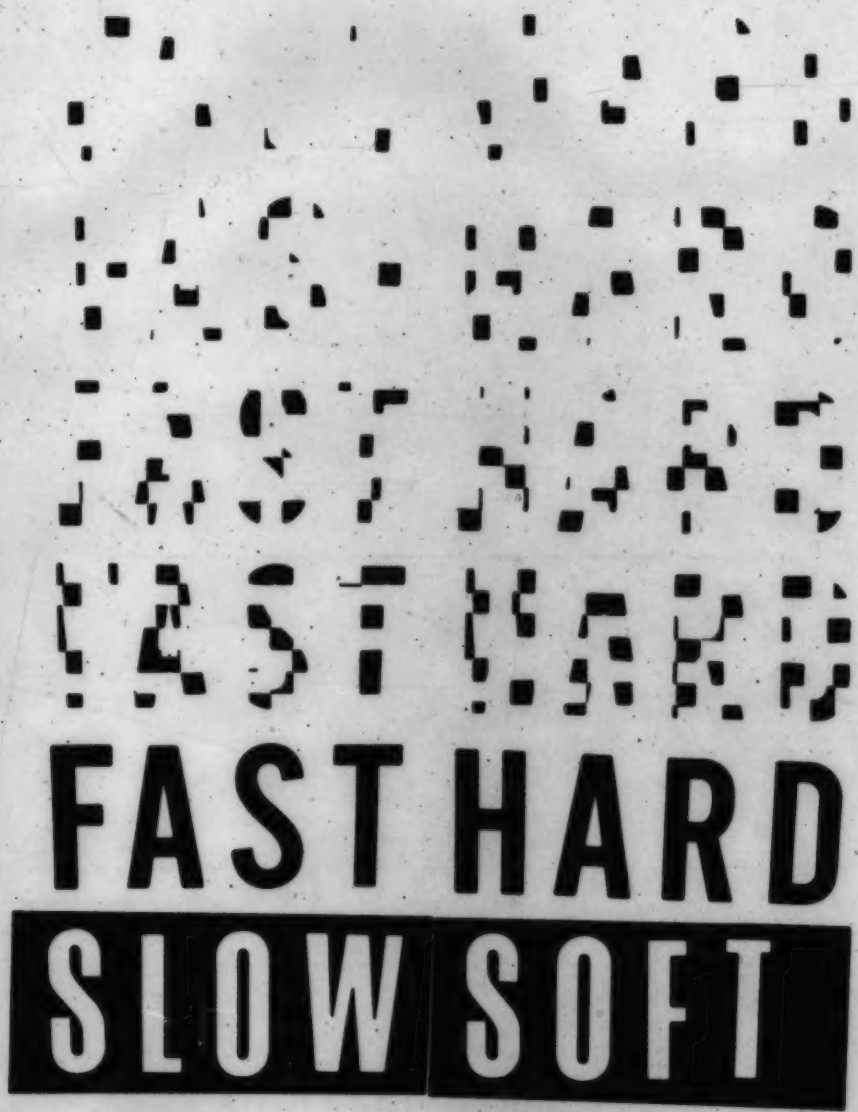
20%

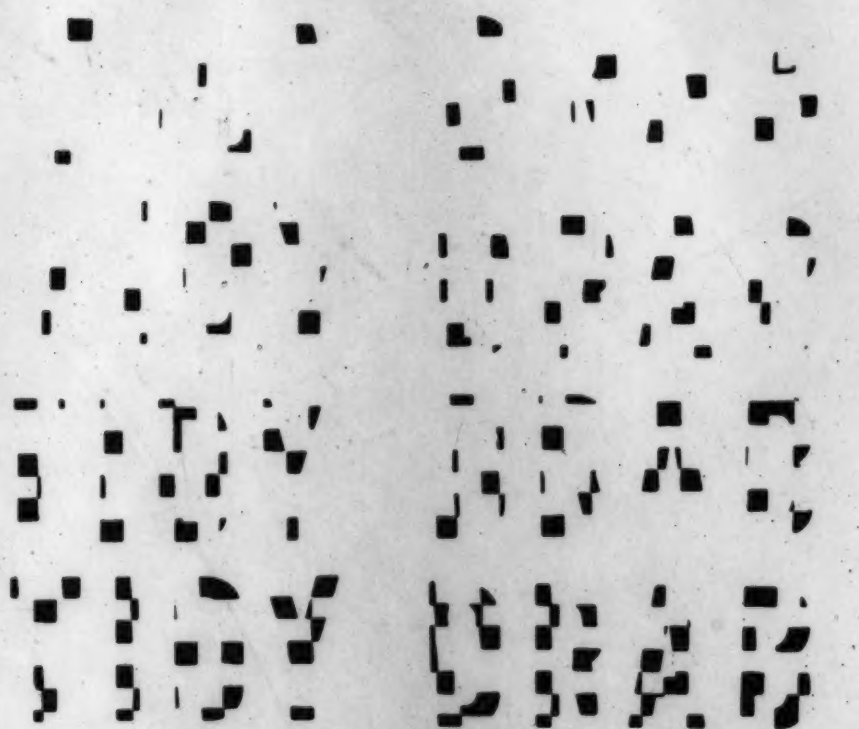
30%

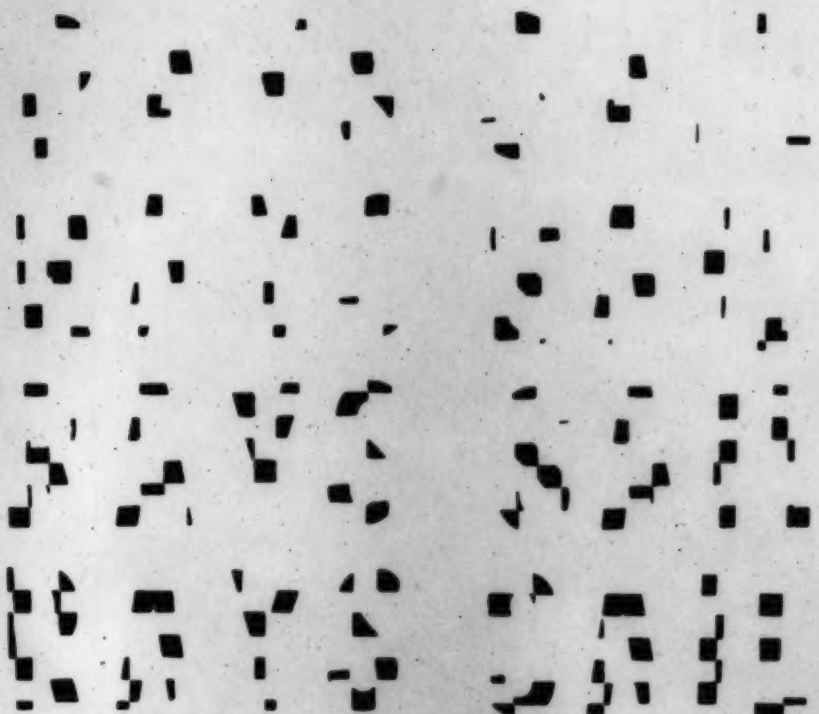
40%

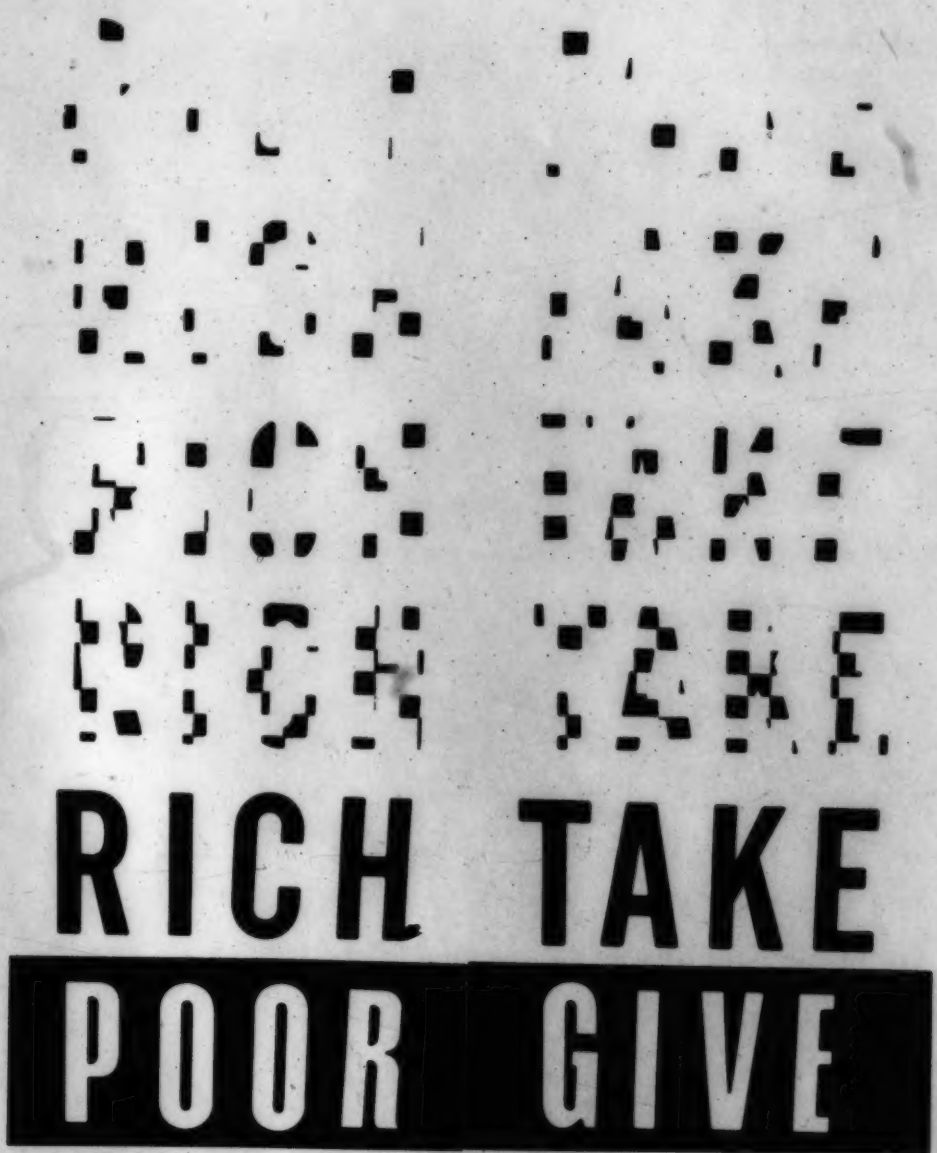


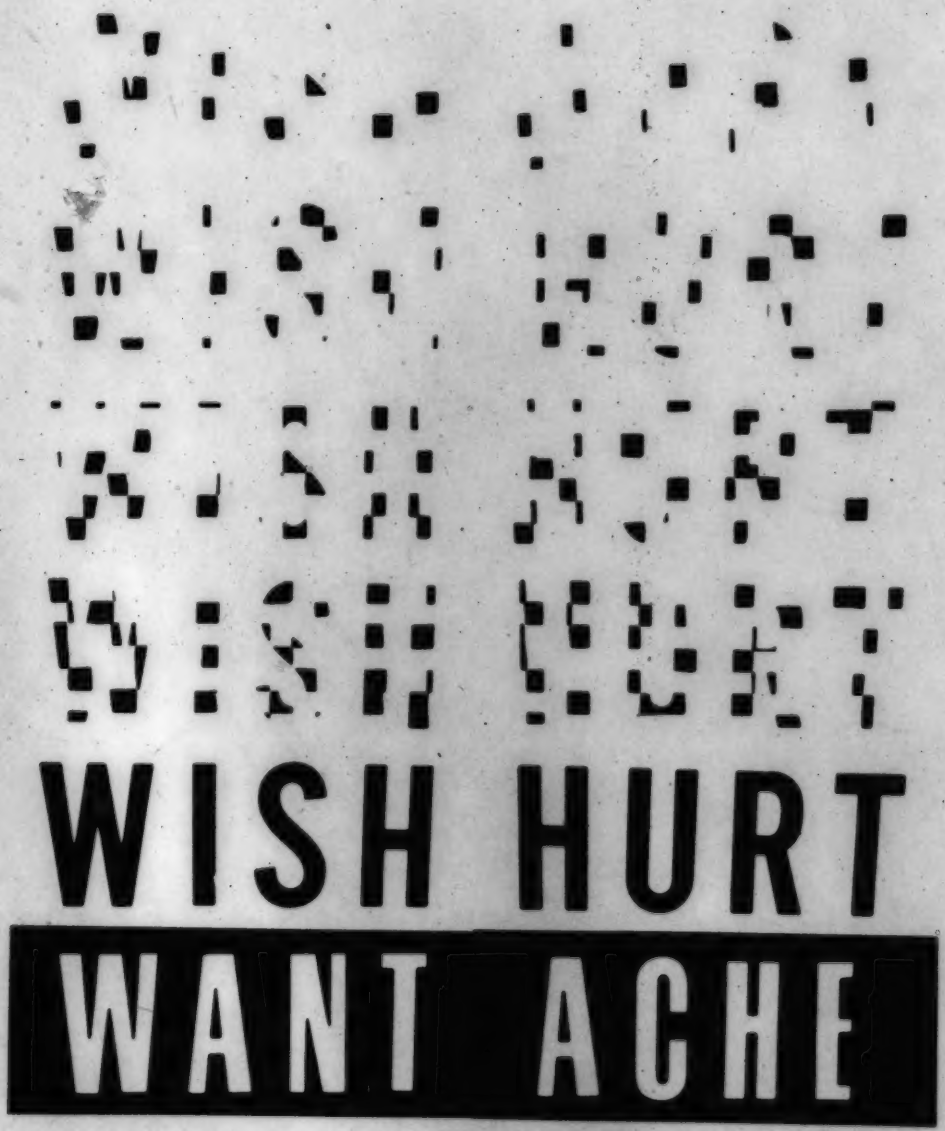
FRAGMENTED WORDS IN THE ORDER OF 10%, 20%, 30%, 40%, 100%, AND FOLLOWED BY THE CUE WORDS. (IN THE EXPERIMENT, STIMULUS AND CUE WORDS WERE SHOWN AS WHITE IMAGES ON BLACK BACKGROUNDS).


FAST HARD
SLOW SOFT


TIDY DRAB
NEAT DULL


RAYS SAIL
RAZE SALE


RICH TAKE
POOR GIVE


WISH HURT
WANT ACHE

FARE LIAR
FAIR LYRE

LIST OF 12 ORDERS (RANDOMIZED) FOR TESTING RECALL FOR 6 OLD AND 6 NEW WORDS

List	Type 1st	Random List	ORDER 1	2	3	4	5	6	7	8	9	10	11	12
	A	1.	FAST	LIAR	HURT	RAYS	TAKE	DRAB	SAIL	RICH	TIDY	FARE	WISH	HARD
	P	2.	RAYS	HURT	TAKE	DRAB	FARE	HARD	TIDY	LIAR	FAST	WISH	RICH	SAIL
	S	3.	TIDY	RICH	LIAR	HARD	WISH	RAYS	FAST	HURT	SAIL	TAKE	FARE	DRAB
B														
	A	4.	HARD	WISH	FARE	TIDY	RICH	SAIL	DRAB	TAKE	RAYS	HURT	LIAR	FAST
	P	5.	SAIL	TAKE	WISH	FAST	LIAR	TIDY	HARD	FARE	DRAB	RICH	HURT	RAYS
	S	6.	DRAB	FARE	RICH	SAIL	HURT	FAST	RAYS	WISH	HARD	LIAR	TAKE	TIDY
	P	7.	FARE	HARD	DRAB	TAKE	RAYS	WISH	RICH	TIDY	LIAR	FAST	SAIL	HURT
	S	8.	WISH	RAYS	HARD	FARE	DRAB	TAKE	LIAR	FAST	HURT	SAIL	TIDY	RICH
	A	9.	TAKE	DRAB	RAYS	WISH	HARD	FARE	HURT	SAIL	RICH	TIDY	FAST	LIAR
A														
	S	10.	HURT	FAST	SAIL	RICH	TIDY	LIAR	TAKE	RAYS	WISH	HARD	DRAB	FARE
	A	11.	RICH	SAIL	TIDY	LIAR	FAST	HURT	FARE	DRAB	TAKE	RAYS	HARD	WISH
	P	12.	LIAR	TIDY	FAST	HURT	SAIL	RICH	WISH	HARD	FARE	DRAB	RAYS	TAKE

LIST OF 12 ORDERS (RANDOMIZED) TO CUE ABOVE LISTS OF WORDS

List	Type 1st	Random List	ORDER 1	2	3	4	5	6	7	8	9	10	11	12
	A	1.	SLOW	LYRE	ACHE	RAZE	GIVE	DULL	SALE	POOR	NEAT	FAIR	WANT	SOFT
	P	2.	RAZE	ACHE	GIVE	DULL	FAIR	SOFT	NEAT	LYRE	SLOW	WANT	POOR	SALE
	S	3.	NEAT	POOR	LYRE	SOFT	WANT	RAZE	SLOW	ACHE	SALE	GIVE	FAIR	DULL
B														
	A	4.	SOFT	WANT	FAIR	NEAT	POOR	SALE	DULL	GIVE	RAZE	ACHE	LYRE	SLOW
	P	5.	SAIL	GIVE	WANT	SLOW	LYRE	NEAT	SOFT	FAIR	DULL	POOR	ACHE	RAZE
	S	6.	DULL	FAIR	POOR	SALE	ACHE	SLOW	RAZE	WANT	SOFT	LYRE	GIVE	NEAT
	P	7.	FAIR	SOFT	DULL	GIVE	RAZE	WANT	POOR	NEAT	LYRE	SLOW	SALE	ACHE
	S	8.	WANT	RAZE	SOFT	FAIR	DULL	GIVE	LYRE	SLOW	ACHE	SALE	NEAT	POOR
	A	9.	GIVE	DULL	RAZE	WANT	SOFT	FAIR	ACHE	SALE	POOR	NEAT	SLOW	LYRE
A														
	S	10.	ACHE	SLOW	SALE	POOR	NEAT	LYRE	GIVE	RAZE	WANT	SOFT	DULL	FAIR
	A	11.	POOR	SALE	NEAT	LYRE	SLOW	ACHE	FAIR	DULL	GIVE	RAZE	SOFT	WANT
	P	12.	LYRE	NEAT	SLOW	ACHE	SALE	POOR	WANT	SOFT	FAIR	DULL	RAZE	GIVE

LIST OF 4 LEARNING TRIAL ORDERS

Learn Trail (B Set)

	Position						Type					
	1	2	3	4	5	6	1	2	3	4	5	6
1	Fast	Tidy	Rays	Hard	Drab	Sail	A	S	P	A	S	P
2	Tidy	Hard	Sail	Drab	Rays	Fast	S	A	P	S	P	A
3	Rays	Drab	Fast	Sail	Hard	Tidy	P	S	A	P	A	S
4	Sail	Fast	Drab	Hard	Rays	Tidy	P	A	S	A	P	S

Learn Trial (A Set)

1	Rich	Wish	Liar	Take	Hurt	Fare	A	S	P	A	S	P
2	Wish	Take	Fare	Hurt	Liar	Rich	S	A	P	S	P	A
3	Liar	Hurt	Rich	Fare	Take	Wish	P	S	A	P	A	S
4	Fare	Rich	Hurt	Take	Liar	Wish	P	A	S	A	P	S

APPENDIX C

DATA

AMNESIC SUBJECTS

Word-Type Antonym Error Scores for Learning Trials (One to Four) and for Cued Trails with Old and New Words

S#	1	2	3	4	Old	New
1	3	1.5	1.5	2	2	4
2	4	2.5	2.5	1	1.5	3
3	4	3.5	3.5	3.5	3.5	2.5
4	4	4	4	4	4	4
5	4	3	1.5	2	2.5	3.5
6	4	4	4	3	2.5	4
7	3.5	3.5	4	3.5	3.5	4
8	4	4	4	2.5	2	3
9	4	4	4	4	4	3.5
10	3	1.5	1.5	1.5	0.5	1.5
Total	37.5	31.5	30.5	27.0	26.0	33.0
Mean	3.8	3.2	3.1	2.7	2.6	3.3

AMNESIC SUBJECTS

Word-Type Synonym Error Scores for Learning Trials (One to Four) and for Cued Trials With Old and New Words

S#	1	2	3	4	Old	New
1	3.5	4	3.5	2.5	2.5	3.5
2	3.5	2.5	2.5	2.5	2.5	4
3	2.5	3	2.5	2.5	2.5	3
4	4	4	4	4	4	4
5	4	4	2.5	3	2.5	4
6	4	3.5	4	3.5	3.5	4
7	3.5	3.5	3.5	4	4	4
8	4	4	3	2	2.5	4
9	4	4	3.5	4	4	4
10	3	3	2.5	2	1.5	3
Total	36.0	35.5	31.5	30.0	29.5	37.5
Mean	3.6	3.6	3.2	3.0	3.0	3.8

AMNESIC SUBJECTS

Word-Type Homonym Error Scores for Learning Trials (One to Four) and for Cued Trials With Old and New Words

S#	1	2	3	4	Old	New
1	4	3.5	3	3	4	4
2	3.5	3.5	3	3	3	3.5
3	3.5	3.5	3	3	2.5	4
4	4	4	4	4	4	4
5	4	3.5	2.5	2.5	3.5	4
6	4	4	4	4	3.5	4
7	3.5	3.5	3.5	3	3.5	4
8	4	4	4	2.5	2	4
9	4	4	4	4	4	4
10	3.5	3	3	3	2.5	3.5
Total	38.0	36.5	34.0	32.0	32.5	39.0
Mean	3.8	3.7	3.4	3.2	3.3	3.9

HOSPITAL CONTROL SUBJECTS

Word-Type Antonym Error Scores for Learning Trials (One to Four) and for Cued Trials with Old and New Words

S#	1	2	3	4	Old	New
1	4.0	3.5	1.5	2.5	1.5	2.5
2	2.0	1.5	1.0	1.5	0.0	1.5
3	3.5	3.0	2.5	2.5	1.5	3.5
4	4.0	4.0	1.5	1.5	2.5	4.0
5	4.0	3.5	3.0	3.0	2.0	3.5
6	3.5	3.5	3.5	3.5	3.0	4.0
7	3.5	3.0	3.5	3.0	3.0	4.0
8	4.0	3.0	3.0	3.0	2.0	4.0
9	2.5	3.0	3.5	2.0	2.5	3.5
10	4.0	3.5	4.0	3.0	2.0	1.0
11	3.5	3.0	3.0	1.0	1.0	4.0
Total	38.5	34.5	30.0	26.5	21.0	35.5
Mean	3.5	3.1	2.7	2.4	1.9	3.2

HOSPITAL CONTROL SUBJECTS

Word-Type Synonym Error Scores for Learning Trials (One to Four) and for Cued Trials with Old and New Words

S#	1	2	3	4	Old	New
1	3.5	3.0	2.5	2.0	2.0	1.5
2	3.0	2.0	2.0	1.5	1.0	2.0
3	3.5	3.5	3.0	3.0	3.0	4.0
4	4.0	4.0	2.5	3.0	3.5	4.0
5	4.0	2.5	2.5	2.5	2.5	4.0
6	4.0	4.0	4.0	3.5	3.5	4.0
7	3.5	3.5	2.0	2.5	3.0	4.0
8	4.0	4.0	3.5	4.0	3.5	3.5
9	3.0	3.0	3.0	3.0	3.0	4.0
10	3.0	3.5	3.0	3.0	1.5	2.5
11	4.0	2.0	2.0	1.0	1.5	3.5
Total	39.5	35.0	30.0	29.0	28.0	37.0
Mean	3.6	3.2	2.7	2.6	2.6	3.4

HOSPITAL CONTROL SUBJECTS

Word-Type Homonym Error Scores for Learning Trials (One to Four) and for Cued Trials with Old and New Words

S#	1	2	3	4	Old	New
1	3.5	3.0	3.0	2.5	3.0	3.5
2	3.0	2.0	2.0	2.5	0.0	3.5
3	4.0	3.5	3.5	3.0	3.0	3.5
4	4.0	4.0	4.0	3.5	3.0	4.0
5	4.0	4.0	2.5	2.5	2.5	4.0
6	4.0	3.5	3.5	3.5	3.0	4.0
7	3.5	3.0	2.5	3.0	3.0	4.0
8	4.0	4.0	3.5	3.5	3.5	4.0
9	3.5	3.5	3.0	3.5	3.5	3.0
10	4.0	3.5	3.5	4.0	1.5	3.0
11	4.0	3.5	3.5	2.5	2.5	4.0
Total	41.5	37.5	34.5	34.0	28.5	40.5
Mean	3.8	3.4	3.1	3.1	2.6	3.7

NORMAL CONTROL SUBJECTS

Word-Type Synonym Error Scores for Learning Trials (One to Four) and for Cued Trials with Old and New Words

S#	1	2	3	4	Old	New
1	4.0	3.0	3.0	3.0	1.5	3.5
2	3.5	2.0	1.5	1.5	0.5	2.0
3	3.5	3.0	2.5	1.5	1.5	2.0
4	2.5	2.5	1.5	1.5	1.0	2.0
5	3.5	1.5	1.5	1.5	0.0	1.0
6	3.5	2.5	2.0	2.0	1.5	2.5
Total	20.5	14.5	12.0	11.0	6.0	13.0
Mean	3.4	2.4	2.0	1.8	1.0	2.2

NORMAL CONTROL SUBJECTS

Word-Type Antonym Error Scores for Learning Trials (One to Four) and for Cued Trials with Old and New Words

S#	1	2	3	4	Old	New
1	3.5	2.5	2.5	2.0	0.5	3.0
2	3.5	2.0	1.5	1.0	1.5	2.0
3	2.5	1.5	1.5	1.0	0.0	2.0
4	4.0	3.5	1.5	2.5	1.5	0.0
5	3.5	2.0	1.5	1.5	0.5	2.0
6	2.5	2.0	1.5	1.5	1.0	1.0
Total	19.5	13.5	10.0	9.5	5.0	10.0
Mean	3.3	2.3	1.7	1.6	0.8	1.7

NORMAL CONTROL SUBJECTS

Word-Type Homonym Error Scores for Learning Trials (One to Four) and for Cued Trials with Old and New Words

S#	1	2	3	4	Old	New
1	4.0	3.5	4.0	3.5	2.0	4.0
2	3.5	3.0	2.5	3.0	2.5	3.0
3	3.5	3.0	2.5	2.0	2.0	4.0
4	3.0	3.0	1.5	1.5	1.5	4.0
5	3.5	2.0	2.0	2.0	2.0	3.5
6	3.5	3.0	3.0	3.0	1.5	3.0
Total	21.0	17.5	15.5	15.0	11.5	21.5
Mean	3.5	2.9	2.6	2.5	1.9	3.6

AMNESIC SUBJECTS

Number of Direct Intrusions of Cues for

Old and New Words

S#	Old			New		
	Ant	Syn	Homo	Ant	Syn	Homo
1	0	0	2	0	0	1
2	0	0	0	0	0	0
3	1	1	0	0	1	3
4	0	0	0	0	0	0
5	0	0	2	0	0	0
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	0	0	0
10	0	0	0	0	0	0
Total	1	1	4	0	1	4
%	16	16	67	0	20	80

HOSPITAL CONTROL SUBJECTS

Number of Direct Intrusions of Cues for

Old and New Words

S#	Old			New		
	Ant	Syn	Homo	Ant	Syn	Homo
1	0	0	0	1	0	0
2	0	0	0	0	0	0
3	0	0	1	0	0	1
4	0	0	0	0	0	0
5	2	3	2	2	1	2
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	1	0	0	0	0
10	3	2	1	1	2	2
11	0	1	2	0	1	2
Total	5	7	6	4	4	7
%	28	39	33	27	27	47

NORMAL SUBJECTS

Number of Direct Intrusions of Cues for

Old and New Words

S#	Old			New		
	Ant	Syn	Homo	Ant	Syn	Homo
1	0	0	0	0	0	0
2	0	0	0	0	0	0
3	0	0	0	0	0	0
4	0	0	0	0	0	0
5	0	0	0	0	0	0
6	0	0	0	0	0	0
Total	0	0	0	0	0	0
%	-	-	-	-	-	-

Percent Gain Scores for the Cueing of Old Items Formula for Conversion from Error Scores: 100 X (Last Learning Trial-Cued Performance Trial) ÷ Last Learning Trial

Amnesic Subjects	Antonyms	Synonyms	Homonyms
1	0.0	0.0	-33.0
2	-50.0	0.0	0.0
3	0.0	0.0	16.7
4	0.0	0.0	0.0
5	-25.0	16.7	-40.0
6	16.7	0.0	12.5
7	0.0	0.0	-16.7
8	20.0	-25.0	20.0
9	0.0	0.0	0.0
10	66.7	25.0	16.7

Hospital Controls	Antonyms	Synonyms	Homonyms
1	40.0	0.0	-20.0
2	100.0	33.3	100.0
3	40.0	0.0	0.0
4	-66.7	-16.7	14.3
5	33.3	0.0	0.0
6	14.3	0.0	14.3
7	0.0	-20.0	0.0
8	33.3	12.5	0.0
9	-25.0	0.0	0.0
10	33.3	50.0	62.5
11	0.0	-50.0	0.0

Normal Controls	Antonyms	Synonyms	Homonyms
1	75.0	50.0	42.9
2	-50.0	66.7	16.7
3	100.0	0.0	0.0
4	40.0	33.3	0.0
5	66.7	100.0	0.0
6	33.3	25.0	50.0

Percent Gain Scores for the Cueing of New Items Formula for Conversion from Error Scores: 100 X (First Learning Trial-Cued Performance Trial) ÷ First Learning Trial

Amnesic Subjects	Antonyms	Synonyms	Homonyms
1	-33.3	0.0	0.0
2	25.0	-14.3	0.0
3	37.5	-20.0	-14.0
4	0.0	0.0	0.0
5	12.5	0.0	0.0
6	0.0	0.0	0.0
7	-14.3	-14.3	-14.0
8	25.0	0.0	0.0
9	12.5	0.0	0.0
10	50.0	0.0	0.0

Hospital Controls	Antonyms	Synonyms	Homonyms
1	37.5	57.1	0.0
2	25.0	33.3	-16.7
3	0.0	-14.3	12.5
4	0.0	0.0	0.0
5	12.5	0.0	0.0
6	-14.3	0.0	0.0
7	14.3	14.3	14.3
8	0.0	12.5	0.0
9	-40.0	-33.3	14.3
10	75.0	16.7	25.0
11	-14.0	12.5	0.0

Normal Controls	Antonyms	Synonyms	Homonyms
1	14.3	12.5	0.0
2	42.9	42.9	14.3
3	20.0	42.9	-14.3
4	100.0	20.0	-33.3
5	42.9	71.4	0.0
6	60.0	28.6	14.3

Recalled Words

	Old Words (exposed 5 times)			New Words (exposed once)			Cue Words (exposed once)		
Amnesic Subjects	Ant	Syn	Homo	Ant	Syn	Homo	Ant	Syn	Homo
1		1		1					
2	1	1				1	1	1	
3							1	2	1
4	2			1			1	1	1
5									
6		1	1						
7	1		1						
8			1			1			
9		1					1		
10	1	1	2		1				
Σ	5	5	5	2	1	2	4	4	2
Hospital Controls									
1	1	1	2					1	1
2	1	1	1				1		
3	1		2						
4	2	1	1						
5				1		1	1		
6				1					
7	1						1		
8									
9	2	1	2						
10	1		1	1					
11		2	2						
Σ	9	6	11	3	0	1	3	1	1
Normal Controls									
1	2	2	1	1	1	2	1		2
2	1	1	2	1		1	2		2
3	1	1	1			1			
4	1	1				1	1	1	1
5	1	1	1	1	1		2	2	1
6	1	1	1	1					1
Σ	7	7	6	4	2	5	6	3	7

APPENDIX D

SUBJECT DESCRIPTION

Amnesic Subject Description

Coded Initials	Subject #	Age	Grade Accomplished	Diagnoses
BOJK	1	51	7	Left Temporal Lobe Dysfunction
SLAF	2	45	9	Left Temporal Lobe Dysfunction
SYOB	3	66	9	Korsakoff
MNOJ	4	56	12	Korsakoff
DLAM	5	58	8	Korsakoff
WLCM	6	51	2 Years Univ	Left Temporal Lobe Damage
BOCS	7	48	11	Post-Traumatic Amnesia
ATEP	8	59	10	Korsakoff
BKNI	9	22	1 Year Univ.	Post-Traumatic Amnesia
SLOW	10	58	9	Left Temporal Lobectomy

Age and Grade Completed of Amnesic and Control Subjects

Amnesic Subjects	Age	Grade Completed
1	51	7
2	45	9
3	66	9
4	56	12
5	58	8
6	51	2 Years Univ.
7	48	11
8	59	10
9	22	1 Year Univ.
10	58	9
Total	514	102
Mean	51.4	10.2
Hospital Controls		
1	47	11
2	47	12
3	55	11
4	59	7
5	57	10
6	45	12
7	34	8
8	48	8
9	49	12
10	27	10
11	42	12
Total	510	113
Mean	46.4	10.3
Normal Controls		
1	52	9
2	45	10
3	36	8
4	40	10
5	22	11
6	41	10
Total	236	58
Mean	39.3	9.7